

# Strategy Research Project International Fellow

## Climate Change and Future World

by

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# USAWC STRATEGY RESEARCH PROJECT

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## **Abstract**

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Climate change, as a security problem, is a global problem that could affect everybody, everywhere, in several policy fields, and in many cases with negative repercussions. In particular, it constitutes a “threat multiplier” that accelerates and amplifies existing trends, tensions, and instabilities. Without control, climate change will have, in the future, security consequences of similar magnitude to the World Wars, but which will last for centuries. But unlike the World Wars, to deal effectively with the challenges posed by climate change, it is necessary to use the tools that constitute so called soft power. For this reason it is essential to achieve a holistic, interdisciplinary, and interagency approach that encompasses and integrates all the elements of national power. In particular, to cope with climate change it is necessary to follow six paths: mitigation, adaptation, economic development, effective capacity of governance, complete and accurate information, and the reinforcement of relationships and collaborations.





## **Climate Change and Future World**

After years of debate, there is numerous scientific data confirming, with increasingly high levels of certainty, that climate change is a process already underway, with evident effects and potentially very serious consequences: temperatures are rising, glaciers and polar ice caps are melting, and extreme weather events such as floods and droughts are becoming more recurrent and more intense. Experts still have some doubts, but their uncertainties are when and where the consequences will occur and not if they will occur.

Climate change poses significant risks for our planet and for future generations. These risks involve not only the environment, but also include threats of humanitarian, economic, political and military nature. This is why climate change is one of the major challenges that humanity will have to face in the future.

Humankind has been able to evolve and progress thanks to the fact that our planet has provided, over the last millennia, particularly favorable environmental conditions. The environment, in fact, is the common platform on which all human activities are based.<sup>1</sup> So, if political, social, cultural, religious, and ... economic systems are to remain secure and viable, the environment must also remain secure and viable.<sup>2</sup>

In particular, climate change constitutes a “threat multiplier”<sup>3</sup> that accelerates and amplifies existing trends, tensions, and instabilities. But these threats are not felt equally around the world. The greatest threats associated with climate change loom over already fragile states and regions, which would be particularly vulnerable - from the geographical, environmental, institutional, and socio-economic point of view - to the effects of climate change itself.<sup>4</sup> When essential resources are not available due to

climate change and degraded environmental conditions, some societies can become overstressed, sometimes to the point of collapse.<sup>5</sup>

But this is not all, because the effects of climate change in one country or region could have impacts on others around the world, even on those countries that now are stable and secure. Without control, climate change will have, in the future, security consequences of comparable magnitude to the World Wars, but which will last for centuries.<sup>6</sup>

But unlike the World Wars, which were solved mainly using military force (hard power), to deal effectively with the challenges posed by climate change, it is necessary to use different tools, in particular those that constitute so called soft power. It is clear that climate change, as a security problem, is a global problem that could affect everybody, everywhere, in several policy fields, and in many cases with negative repercussions.<sup>7</sup>

For this reason, it is essential to achieve a holistic, interdisciplinary, and interagency approach that encompasses and integrates all the elements of national power: national and international institutions and organizations that include climate change science into their strategic planning; diplomacy that undertakes initiatives aimed at creating effective international organizations able to cope with the threats posed by climate change; adequate information about the problem and its consequences, available for institutions and common people; military prepared to deal with more crisis prevention and humanitarian emergencies; and economy willing to invest resources and efforts in sustainable, energy-efficient technologies.<sup>8</sup>

The purpose of this research is to examine the security consequences of climate change. This paper provides an initial examination of the causes of climate change, both natural and human-induced, and its effects on the natural environment and social systems. Then, it analyzes the effects on specific geographic areas and the related security implications. Eventually, it proposes some strategies for the future and some recommendations.

### Causes of Climate Change<sup>9</sup>

The Earth is essentially an enormous thermal machine that absorbs energy from the sun, transforms and reworks it in different forms, and then re-emits into space the power that has not been used. This enormous thermal machine, that is the climate system, is constituted by the atmosphere, oceans, biosphere and geosphere. Climate<sup>10</sup> is simply the result of the energy balance that exists in this complex system.

Some gases naturally present in the atmosphere, such as carbon dioxide, ozone, water vapor and methane, create the so-called greenhouse effect. The greenhouse effect, a natural phenomenon, prevents a part of the solar heat from escaping into space by reflecting it back down to the Earth's surface, and ensures the heating of the planet.<sup>11</sup> Without this effect, the average temperature of the planet would be around -18° C, well below the freezing point of the water and minimum conditions to allow life.

Unfortunately, human activities are changing the thermal capacity of this delicate and complex system, introducing disruptive factors capable of modifying the climatic equilibrium. In other words, human activities are creating a manmade greenhouse effect in addition to the natural one, which tends to change the balance of the climate system. The human activities effecting this, include:

- massive use of fossil fuels, which produces a significant increase in the concentration of greenhouse gases, including carbon dioxide, in the atmosphere;
- the destruction at an alarming rate of woods and forests that, through the processes of photosynthesis, are the main source of absorption and recycling of atmospheric carbon dioxide;
- the transformation of the Earth's surface, due to the intense and extensive urbanization, intensive use of land for agriculture, and pollution of land and sea, that is altering the capacity of absorption and reflection of the Earth.

### Physical Effects of Climate Change

The environmental consequences generated by these human interferences are numerous, and they will influence almost every aspect of human society, including economic prosperity, human and environmental health, and security.<sup>12</sup> According to the Forth Assessment Report of the Intergovernmental Panel on Climate Change<sup>13</sup> (IPCC), the main changes concern the following aspects.

#### Temperature

A large amount of studies and scientific results confirm that the climate system is warming. Experts believe that in the coming years the global temperature will continue to increase at a faster pace than in the past. As stated by the IPCC, global warming is irrefutable, as is now clear from observations of increases in global average air and sea temperatures, widespread melting of snow and ice, and rising global average sea level.<sup>14</sup>

#### Ice and Snow<sup>15</sup>

Numerous scientific data confirm that the size and extension of the Arctic ice and mountain glaciers in the northern hemisphere are reducing. According to the IPCC, the

Arctic Ocean could be free of summer ice by the end of this century, with some studies indicating that this could happen before 2040. Glaciers and terrestrial ice sheets are expected to continue to reduce their mass. These phenomena will increase the global sea level. The thawing of permafrost will increase in many areas of the northern hemisphere.

### Precipitation and Drought<sup>16</sup>

Precipitation is increasing, especially in the northern hemisphere, and particularly in the regions of middle and high latitudes. In subtropical regions, by contrast, there is a clear downward trend, which also involves the surrounding regions of the mid-latitudes. In particular, the phenomena of increased drought are evident in the Sahel region<sup>17</sup>, East Asia, and Southern Africa. Increases in drought phenomena also occurred in southern Europe and in the southern part of the United States.

### Sea Level

Global average sea level progressively rose during the last century, and it rose at an average rate of about 3.1 mm per year from 1993 to 2003.<sup>18</sup> On long term scales, two major processes cause changes in global average sea level: expansion of the ocean volume due to global warming, and the exchange of water between the oceans and land reservoirs of water, including glaciers and land ice sheets.<sup>19</sup>

### Extreme Weather Events<sup>20</sup>

Number, power and duration of some extreme weather events have increased over the last 50 years. Heat waves and heavy precipitation events have become more frequent and the tropical cyclone activity has increased in many regions all over the world. These changes will influence almost every aspect of human life, including economic prosperity, human and environmental health, and security.<sup>21</sup>

## Destabilizing Socio-Economic Effects of Climate Change

Some of the ways in which climate change is likely to adversely impact the environment and human systems are the following.

### Water

Water is undoubtedly the most important resource for human life. However, the present, and even more the future, human pressure on water resources and, in particular, on their use and their management, will tend to become more acute with climate change.<sup>22</sup>

Scientists predict that climate change will modify the hydrological cycles. The effects of such changes will be felt differently across the globe, with some areas seeing increasing water flows ... others experiencing accelerating erosion and siltation ... and still others suffering from a reduction in water availability.<sup>23</sup>

Worldwide, almost half a billion people currently suffer from water scarcity, and these numbers are likely to increase due to the changes of surface water levels induced by climate change.<sup>24</sup> This could be a serious problem particularly in developing countries that are moving from agricultural production to industry.<sup>25</sup>

### Health

Climate impacts on health are complex and will be influenced by multiple factors, including demographics; population and regional vulnerabilities; the social, economic, and cultural context; availability of resources and technological options; built and natural environments; public health infrastructure; and the availability and quality of health and social services.<sup>26</sup>

In some regions, higher temperatures and more frequent rainfalls could increase the occurrence of water-borne diseases such as cholera and malaria which, if uncontrolled, could generate epidemics.<sup>27</sup> More frequent and more intense extreme

weather events such as storms and cyclones could cause many casualties, putting pressure on already limited medical capabilities.<sup>28</sup> Heat waves and water scarcity could jeopardize safe drinking water and hygiene, affecting the poorest and most marginalized communities.<sup>29</sup> Failure by the institutions to provide for basic public health in fragile states is a fundamental factor that erodes their legitimacy, which leads to increased political instability and violent conflict.<sup>30</sup>

### Agriculture, Food Production, and Marine Resources

Vulnerability of this sector to climate change is a function of many interacting factors, including pre-existing climatic and soil conditions, changes in pest competition, water availability, and the sector's capacity to cope and adapt through management practices, and changes in economic competition among regions.<sup>31</sup>

The IPCC predicts that crop yields could fall in many regions due to higher temperatures, including ones that are already suffering from food insecurity, such as Southern Africa, Central Asia and South Asia.<sup>32</sup> Higher sea levels could reduce the extension of cultivable areas in South Asia and in other regions around the world, affecting a great number of people.<sup>33</sup>

In addition, the agricultural production could be adversely affected due to the deterioration of the quality of the soil. In particular, in the northern hemisphere, the deterioration may be caused primarily by increased leaching of soils due to increased precipitation and increased risks of flooding.<sup>34</sup> In the southern hemisphere, on the contrary, the deterioration can be caused by the degradation of soil erosion and loss of nutrients due to reduced rainfall and increased risk of drought.<sup>35</sup>

Climate change could also modify significantly the marine environment. In accordance with the Food and Agriculture Organization<sup>36</sup> (FAO), higher water temperatures already are affecting aquatic flora and varying the distribution of fish

species.<sup>37</sup> Increasing ocean acidification is threatening coral reefs that play an important role in mitigating the effects of sea storms surges.<sup>38</sup> Climate change could also jeopardize the fishing industry in the future. Changes in temperature and salinity of the water, raised UV-B radiation levels, and modified ocean currents all could worsen existing pressure on fish stocks.<sup>39</sup>

### Migration and Urbanization

The effects of climate change, whether they take the form of a gradual change either they occur as extreme changes, could lead to an increase of migration flows.<sup>40</sup> These important population movements are likely to involve mainly the countries that are most vulnerable to the effects of climate change.

Most of these movements will happen probably within national borders, but some of them will also have an international dimension.<sup>41</sup> In each case, those leaving nonviable areas will often migrate to areas that are already only barely viable ... adding to ... poverty, conflict and, probably, criminality.<sup>42</sup>

This phenomenon will accelerate urbanization, especially in developing countries, increasing the number of poor people in slums and other peripheral areas that have inadequate infrastructures, means and capabilities to deal with climate-related emergencies.<sup>43</sup>

But climate change will also affect urban areas in other ways: sea level rise, storms and flooding, water scarcity, and the urban heat island effect.<sup>44</sup> About two thirds of the world's populations and economic activities are concentrated in coastal areas and in the vicinity of rivers, and exposed to natural disasters.<sup>45</sup> Higher sea levels can also cause salinity of fresh water, making it non-potable and unsuitable for irrigation.<sup>46</sup>



Increased urbanization will produce changes in the natural morphology of the land, increasing the impervious surfaces with houses and roads.<sup>47</sup> This process could cause flooding and, consequently, the increase of water-borne diseases.<sup>48</sup>

Water scarcity and extreme high temperatures in urban areas can be very dangerous, particularly for the most vulnerable categories of people such as children, old people, and the poor.<sup>49</sup>

### Energy<sup>50</sup>

Reduced water availability and severe weather events may affect energy infrastructures and interfere with electricity transmission and production. Sea level rise and increased risks of storms may hinder the extraction of petroleum, especially from sea-based platforms, and its transport by sea.

### Natural Hazards and Natural Disasters<sup>51</sup>

Similar extreme weather events can have very different consequences in different areas, depending on the available resources and capabilities to respond to such emergencies. In those countries that have adequate mitigation instruments, rarely extreme weather events become humanitarian emergencies, even if these events are more intense and more frequent. Conversely, developing countries don't have the same capacity to cope with climate change effects, and the population is completely undefended from the effects of natural disasters.

### Transportation

The physical effects of climate change can significantly affect the transportation system, including road and rail networks, ports and airports, and pipeline systems.<sup>52</sup>

## Elements of Vulnerability<sup>53</sup>

The global effects outlined above are, however, misleading. The consequences of climate change will occur with significant regional differences, with areas that will be more affected than others. In fact, the degree to which climate change represents a risk for human security is related with the level of vulnerability of the affected people/social system.<sup>54</sup> The IPCC defines vulnerability as

The degree to which a system is susceptible to, and unable to cope with adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity.<sup>55</sup>

Climate change in itself is not a security problem. In fact, the security problems rarely have a single trigger source. Instead, they are normally generated by the interaction of multiple elements of tension that involve political, social, religious, and economic issues.<sup>56</sup> In this context, climate change acts as a stress multiplier for instability.

Key elements of vulnerability are the following.

Political instability. Climate change will increase strain on essential public services such as health care and food security. Failed or fragile states, that are unable to guarantee these fundamental services to their citizens, are particularly at risk.

Economic weakness. Climate change will cause more adverse effects on poor states rather than on developed countries. Poorer states, which tend to have economies based on agriculture, will be more vulnerable to decreasing crop yields, chaotic weather patterns, and migration. Climate change consequences will hamper the economic growth of these states, and will limit their capability to adapt to changing conditions,

worsening already critical social and economic conditions and consequently increasing security instability.

Food insecurity. There are three main reasons that can cause food insecurity: firstly, desertification can cause a loss of cultivable soil; secondly, climate change can reduce the growing seasons; and thirdly, extreme weather events can affect the distribution of food, damaging the land and inland waterway transport networks, due to more frequent flooding and drought. In such circumstances, it is almost unavoidable an increase in social crises and migratory phenomena.

Demographic changes, migration, and urbanization. Migration flows caused by climate change may increase the pressure on communities that already do not have sufficient means of subsistence, whether as a result of significant demographic increases or as a consequence of climate change itself. In such situations, especially if the institutions are weak, the risk of social crises and conflicts is higher.

In large urban areas, with millions of residents, the combined effects of climate change, such as movements of people, scarcity of water and food, health problems, rising sea levels and extreme weather events, may become a big security issue even in the most developed countries. Where institutions are weak, a social catastrophe appears almost unavoidable.

### Regional Security Implications of Climate Change

Whether the consequences of climate change result in security problems depends mainly on the features of the interested country. Nations with strong economies and stable institutions have more capabilities to cope with and adapt to

adverse climatic changes; in contrast, societies that already present elements of instability represent possible cases where climate-related problems might occur.<sup>57</sup>

### Africa

Climate change trends<sup>58</sup>: The African continent is very likely to experience higher temperatures in all seasons, with subtropical areas warmer than the tropics.

Precipitation is likely to decrease in Mediterranean Africa, Sahel region and Southern Africa, while it is likely to increase in East Africa.

Security implications<sup>59</sup>: The African continent is one of the most exposed regions to the effects of climate change due to the simultaneous presence of numerous elements of vulnerability and its limited adaptation capabilities. Water shortage, overexploitation of land, drought, rising sea levels, and salinity will cause the loss of a high percentage of the cultivable areas. This phenomenon will reduce crop yields, increasing food insecurity in many areas with millions of people.

Movements of people, both internally and to Europe, are expected to increase. Climate change will have adverse impacts on health, particularly because of the increase of vector-borne diseases. Such changes will add significantly to existing tensions and can facilitate weakened governance, economic collapse, massive human migrations and potential conflicts.<sup>60</sup>

### Middle East

Climate change trends<sup>61</sup>: Average annual temperatures in the Middle East are likely to be higher than the global mean. The entire area is already affected by a lack of water. Climatic changes will further aggravate this situation in the years to come, with a reduction of rainfall and a higher frequency of drought and heat waves. These trends will particularly affect the agricultural sector, causing a fall of production in many areas.

The majority of the population lives near the sea. Therefore, a vast number of people are exposed to the consequences of storm surges and sea-level rise.

Security implications: This area is characterized by the simultaneous presence of many different actors and several geopolitical elements of instability, including: the Israel-Palestinian conflict, the war in Afghanistan, Iran's nuclear program, and active terrorist organizations.<sup>62</sup>

The entire region is already suffering from a chronic water shortage. Climate change will further exacerbate this situation by reducing up to 60% at the flow of the main rivers, affecting, in particular, the water supplies of Jordan, Palestine, and Israel.<sup>63</sup> Consequently, a net reduction of the agricultural production is expected, that is likely to involve Saudi Arabia, Iraq, Syria, and Turkey as well.<sup>64</sup> This trend will increase food insecurity in the region. Moreover, most of the region is vulnerable to extreme weather events and natural hazards, because of weak institutions and poor infrastructures.<sup>65</sup> Taking into account that the majority of the world's petroleum reservoirs are located in this region, with many countries that are in competition for this precious resource, and that there are enough trigger elements to considerably increase social and economic instability, in such conditions the risk of conflicts is great.<sup>66</sup>

### Mediterranean and Europe

Climate change trends<sup>67</sup>: Due to climatic changes, European countries are expected to experience higher temperatures than the global mean, especially in northern Europe and in the Mediterranean area. Rainfall in northern Europe is expected to increase, while it will decrease in the Mediterranean area. Central Europe and the Mediterranean Area are likely to experience more frequent summer droughts. The snow season will be shorter than now with a consequent decrease of snow levels.

Security implications<sup>68</sup>: The developed European countries will not have too many difficulties coping with the consequences caused by climate change. In Europe there will be an increase of the frequency and intensity of heat waves, and this trend, especially in the Mediterranean area, could increase the risk of tropical diseases, putting more pressure on the health systems. Warmer temperatures and water scarcity will affect the agriculture, in particular in southern Europe where is expected a sensible reduction of productivity. Rising sea levels will affect many infrastructures located in the coastal vicinity, and will cause salinity of water, putting more pressure on the already limited availability of fresh water.

Movements of migrants from northern Africa and the Middle-East are already a security problem for Europe. This phenomenon is likely to be exacerbated by the effects of climate change, and it could jeopardize social stability and put more pressure on the European economic system. Migration has already caused an increase in military presence and, as this trend is likely to increase in the years to come, the armed forces are expected to be more and more involved.

### Asia and Pacific

Climate change trends<sup>69</sup>: Temperatures are expected to be higher than the global mean in Asia. Precipitation is very likely to increase in almost the entire Asiatic continent, but rainfalls are expected to decrease in Central Asia. The duration, the intensity, and the frequency of heat waves during the hot season are expected to increase. In South-Oriental Asia, tropical cyclones are expected to increase their effects, with intense precipitations and strong winds.

Security implications<sup>70</sup>: In South Asia, the majority of the people lives in coastal areas, and higher sea-level may affect the living conditions of billions of persons. Water

scarcity and a reduction of the agricultural production are likely to generate food insecurity for most of the Asian population, which will be more vulnerable to increasing contagious diseases too.

In Central Asia, climate change is exacerbating water scarcity, by modifying precipitations during the monsoon season and reducing the melting water from the Himalayan glaciers. This trend will affect energy production and agriculture, putting more stress on a population of over a billion people. In addition, the region is already characterized by the presence of several elements of instability, such as small-scale territorial disputes, very active terrorist organizations, and increasing social problems.<sup>71</sup> Obviously, the explosion of a major crisis in this part of the world would have global consequences, especially because of the increasing economic and political relevance that countries like China and India are acquiring.<sup>72</sup>

#### North, Central and South America

Climate change trends<sup>73</sup>: Temperatures are expected to be higher than the global average in most areas. Rainfalls are likely to increase in North America, while they are expected to decrease in Central America and in the northern part of South America. In North America, snow seasons are expected to be shorter and snow depth will reduce. In the southern part of South America, winter rainfalls are expected to increase.

Security implications<sup>74</sup>: In Central America and in the Caribbean there are some of the world's poorest countries, and their ability to cope with climate change effects could be insufficient. In the drier regions of South America, climatic changes will cause the loss of most of the cultivable land, due to salinity and desertification. These phenomena will reduce agricultural production and livestock, affecting the food security of a great number of people. In North and Central America, higher sea levels are likely

to increase the probability of flooding, especially in coastal areas. Warmer sea water could jeopardize the survival of coral reefs, and could have negative impacts on fish stocks.

Fresh water resources will be considerably reduced due to the reduction of the glaciers' extensions and variations in frequency and intensity of precipitation, affecting cultivation and energy production. Extreme weather events, such as hurricanes and cyclones, are already affecting the islands in the Caribbean, Mexico, and the United States. All these trends produced by climate change are likely to increase migration movements to the U.S., and the occurrence of humanitarian interventions.<sup>75</sup>

### Polar Regions

Climate change trends<sup>76</sup>: The Arctic is expected to experience higher temperatures than the global average. This warming trend will reduce the extension and the thickness of Arctic sea ice, and it is likely to modify rainfall patterns, increasing precipitation especially in winter. The Antarctic is expected to be warmer and rainfalls are likely to be more frequent and more intense.

Security implications<sup>77</sup>: The reduction of the extension of the Arctic ice cap, especially during the summer, is opening up new commercial routes, and increasing the accessibility of vast precious resources, such as hydrocarbon, gold, silver, and diamonds. These phenomena are modifying the geo-strategic context of the region, with many countries that have already shown their interest in exploiting these new opportunities. This brand new "gold rush" may generate tensions on conflicting interests, with potential adverse impacts on international stability.



## Impacts on Military Systems, Infrastructures, and Operations<sup>78</sup>

According to the Quadrennial Defense Review, climate change will affect the armed forces in two ways: firstly, it will contribute to define the environment, the roles and missions in which the military will be involved, acting as an accelerator of instability and conflicts and increasing the demands for support for civil authorities in the event of humanitarian emergencies and natural disasters, both at home and abroad; secondly, the armed forces will have to be able to adapt to the impacts that climate change will inevitably have on their equipment, infrastructure and capabilities.<sup>79</sup>

Extreme climatic conditions will overstress equipment, vehicles, and weapon systems, increasing their maintenance requirements and significantly reducing their service life. Several infrastructures will be affected by rising sea levels and severe weather events, and many of them will be irremediably damaged or will have to be relocated. Severe weather conditions will have direct impacts on the readiness of the armed forces, hampering land, maritime and air operations, by putting more stress on personnel and equipment, limiting the mobility of vehicles, vessels, helicopters, and airplanes, and affecting energy supplies.

## Strategies for the Future

Climate change, as a security problem, is a complex problem that needs to be addressed with a holistic and multidisciplinary approach. It is necessary, particularly, to act on those elements of vulnerability that have been discussed earlier: the changing climate itself, political instability, economic weakness, and all the situations of human misery, like poverty, diseases, and social inequality.

Generally speaking, there are six main paths to follow: develop and implement strong mitigation measures; sustain the ability to adapt to the effects of climate change,

especially in developing countries; stimulate economic development, adopting measures that are compatible with environmental sustainability; create solid institutional structures, with effective capacity of governance; ensure complete and accurate information in order to properly manage the potential risks associated with climate change; and reinforce international relationships and collaborations in order to cope with trans-national impacts and to prevent and solve crisis related with climate change.

Firstly, to slow down climate change, it is necessary to adopt both mitigation actions in order to reduce greenhouse gas emissions, and adaptation measures that increase resilience<sup>80</sup> to deal with unavoidable impacts. Both approaches are necessary, because even if emissions were dramatically reduced in the future, adaptation would still be needed to address the global changes that are already taking place.

However, the capability to adapt and mitigate is dynamic and is influenced by a society's productive base, including natural and man-made capital assets, social networks and entitlements, human capital and institutions, governance, national income, health and technology.<sup>81</sup>

### Mitigation<sup>82</sup>

Mitigation to ensure valid results must address the root causes of climate change. For this reason, it is necessary to carry out inclusive, fair and effective international actions that will help to reduce greenhouse gas emissions and, consequently, slow down climate change. This involves reducing countries' carbon footprint by accelerating the transformation towards the use of eco-friendly and sustainable energy sources, as well as improving the energy efficiency of equipment and infrastructure; and a massive reduction in the rate of deforestation. Obviously, these mitigation measures should be applied ensuring adequate financial and

technological support to developing countries that, otherwise, would not have the possibility/capabilities to implement these changes.

#### Adaptation<sup>83</sup>

Adaptation, instead involves the prevention of the adverse consequences of climate change, ensuring political, social and economic security and stability. Adaptation requires comprehensive international efforts to increase the resilience of the most vulnerable communities/social groups threatened by the effects of climate change, through adequate support and the implementation of measures aimed to ensure them the essential needs and services, such as food, water, health care, and safety.

Decisive measures to reduce food uncertainty, especially in developing countries, include the use of innovative farming techniques that limit the over-exploitation of soil and optimize the use of water, as well as the selection of crops that are less sensitive to climatic excesses.

An effective health organization, well supported by appropriate medical facilities, proper sanitary education, and adequate resources, is crucial to prevent and limit the adverse impact of climate change on human health, particularly in less developed countries.

Safety of people and infrastructures, especially in the most vulnerable areas, could be enhanced by putting adequate measures in place to prevent, reduce and manage environmental crises related with climate change. It is essential, for example, to identify and implement territorial development plans, especially in the most vulnerable areas, that respect the morphological and hydro-geological characteristics of the territory, in order to minimize the negative impacts that climate change will produce on human settlements, increasing their resilience against extreme natural events.

### Economic Development<sup>84</sup>

Resilience and the capacity to adapt to climate change of a country depend greatly on its economic progress. In addition, economic prosperity usually ensures greater social stability. Therefore, economic development should be based on activities and processes that are not sensitive to the effects of climate change, in order to limit the possibilities that climate change will hamper economic growth and social and political stability.

### Effective Capacity of Governance and Solid Institutional Structures<sup>85</sup>

Effective capacity of governance and solid institutional structures are essential to minimize the security threats induced by climate change.

In fact, climate change, acting as a “threat multiplier”, could exacerbate several factors of instability, reducing the capabilities of many countries to manage effectively environmental crisis, and consequently undermining the legitimacy and credibility of their governments. Thus, it is crucial that public institutions together with all sectors of society, especially the most vulnerable ones, develop and implement comprehensive policies, and effective structures and measures able to successfully tackle climate-related emergencies.

### Complete and Accurate Information<sup>86</sup>

Complete and accurate data and information on climate evolution and its effects on infrastructures and population are indispensable to effectively adapt and respond to climate change impacts.

Climate monitoring systems, early warning systems, and effective communication networks are required to limit damages and casualties caused by extreme weather events.

## Reinforce International Relationships and Collaborations<sup>87</sup>

Climate change will produce trans-national consequences that will require international cooperation, coordination and mediation in order to avoid tensions among countries and negative outcomes. Some of the events that could necessitate preventive diplomacy and international agreements are: trans-boundary migration, disputes over scarce resources, conflicting interests on newly accessible precious natural resources, and rights over maritime zones and new commercial routes.

### Conclusions

Climate is changing and its effects are already being felt around the planet. Even if we succeed in reducing the causes of global warming, the consequences of climate change will affect human security anyway. The vulnerability of our natural environment and society has increased much more than we care to believe, and the potential for climate-related disasters and social crisis is open-ended.

Extreme weather events, such as cyclones and hurricanes, are already causing billions of dollars worth of damages, rising sea levels, massive floods, droughts, food scarcity, migration, and pandemic diseases are devastating threats that can disrupt human society and prosperity.

The list of catastrophic events, due to climate change effects, is unfortunately increasing more and more every day. Therefore, one of the biggest threats to human security, today and even more tomorrow, is not war itself, but natural events of unexpected entity that can have disruptive physical, political, economic, and social effects, especially in developing countries.

These new kinds of threats on human security will not occur in the traditional spectrum of conflict, and it is very likely that many countries will not have the capabilities

to effectively deal with these new types of menaces. To cope with and to win this new type of threat, the coordinated involvement of all the most developed countries is crucial with all their elements of national power.

As we have seen before, most of the efforts must be carried out by political, diplomatic, and economic institutions and agencies, both national and international. Nevertheless, the military also has to play their role, supporting the other institutions in developing and implementing their strategies and measures to prevent and minimize the impacts of climate change. But this could not be enough.

When the destabilizing consequences of climate change become overwhelming, civilian authorities will not be able to tackle such emergencies, and in these kinds of situations, the military forces are always the last resource between order and disorder. In fact, the armed forces are trained to operate in very complex conditions, and their capabilities are crucial when maintaining essential functions and services is vital.

The pure military menaces included in the spectrum of conflict are concrete and tangible threats and need to be addressed in the proper way. But, at the same time, it is mandatory to be aware that the volatile, uncertain, complex, and ambiguous (VUCA) characteristics of the modern strategic environment require more creative and complex responses.

In the future, the armed forces will have two possible perspectives: to remain attached to the past and to prepare to face only “traditional threats”, or to be aware of these changes and organize themselves to execute new missions: climate change-related emergency response is one of them.

## Endnotes

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<sup>10</sup> IPCC definition of Climate: Climate is usually defined as the average weather, or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The relevant quantities are most often surface variables such as temperature, precipitation and wind.

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<sup>12</sup> U.S. Climate Change Science Program, *Climate Literacy – The Essential Principles of Climate Sciences*, 3. (<http://library.globalchange.gov/climate-literacy-the-essential-principles-of-climate-sciences-low-resolution-booklet>) accessed 02/12/2013.

<sup>13</sup> The Intergovernmental Panel on Climate Change (IPCC) was jointly established in 1988, by the World Meteorological Organization (WMO) and the United Nations Environment Program (UNEP), with the mandate to assess scientific information related to climate change, to evaluate the environmental and socio-economic consequences of climate change, and to formulate realistic response strategies.

<sup>14</sup> Intergovernmental Panel on Climate Change, *Climate Change 2007: Synthesis Report*, 30. ([http://www.ipcc.ch/publications\\_and\\_data/publications\\_ipcc\\_fourth\\_assessment\\_report\\_synthesis\\_report.htm](http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm)), accessed 3/06/2013.

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<sup>18</sup> Intergovernmental Panel on Climate Change, *Climate Change 2007: Synthesis Report*, 30. ([http://www.ipcc.ch/publications\\_and\\_data/publications\\_ipcc\\_fourth\\_assessment\\_report\\_synthesis\\_report.htm](http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm)), accessed 3/06/2013.

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<sup>26</sup> Committee on Environment and Natural Resources - National Science and Technology Council, *Scientific Assessment of the Effects of Global Change on the United States*, 14. (<http://www.climatescience.gov/Library/scientific-assessment/>), accessed 3/06/2013.

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<sup>32</sup> Ibid.

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<sup>39</sup> Ibid, 10.

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<sup>45</sup> Ibid.

<sup>46</sup> Ibid.

<sup>47</sup> Ibid.

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(<http://www.cna.org/reports/climate>), accessed 3/06/2013.

<sup>79</sup> Centro Studi di Politica Internazionale, *Cambiamenti Climatici e Governance della Sicurezza: la Rilevanza Politica della Nuova Agenda Internazionale*, (Osservatorio di Politica Internazionale, n. 16 – maggio 2010), 3. (Center for the Studies of International Politics, *Climate Change and Security Governance: the Political Relevance of the New International Agenda*) ([http://www.parlamento.it/documenti/repository/affariinternazionali/osservatorio/approfondimenti/Approfondimento\\_16\\_CESPI\\_Clima.pdf](http://www.parlamento.it/documenti/repository/affariinternazionali/osservatorio/approfondimenti/Approfondimento_16_CESPI_Clima.pdf)), accessed 3/06/2013.

<sup>80</sup> IPCC definition of Resilience: The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization, and the capacity to adapt to stress and change.

<sup>81</sup> Intergovernmental Panel on Climate Change, *Climate Change 2007: Synthesis Report*, 56. ([http://www.ipcc.ch/publications\\_and\\_data/publications\\_ipcc\\_fourth\\_assessment\\_report\\_synthesis\\_report.htm](http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm)), accessed 3/06/2013.

<sup>82</sup> Unless otherwise indicated the content of this section is extracted from: United Nations General Assembly, *Climate Change and its Possible Security Implications*, (Report of the Secretary-General, September 2009), 23-24. (<http://www.unhcr.org/refworld/docid/4ad5e6380.html>), accessed 03/06/2013.

<sup>83</sup> Ibid, 24-25.

<sup>84</sup> Ibid, 25-26.

<sup>85</sup> Ibid, 26.

<sup>86</sup> Ibid.

<sup>87</sup> Ibid.